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Testimony to the Berger Commission Inquiry February 1976

by

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Concerning:

Ringed Seals (Phoca hispida) in the Amundsen Gulf
and southeastern Beaufort Sea. The possible effects
of offshore petroleum exploitation and related
activities.

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EXHIBIT NO. 454 Feb. 11/76

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Introduction

The aboriginal people of the western North American arctic have been dependent on sea mammals since their first occupation of the coastal regions of Alaska over 3,000 years ago (Giddings, 1967, Bandi, 1969). Because the ringed seal (Phoca hispida) is the most abundant of the marine mammals and available throughout the year, it formed the basis of the coastal Inuit economy. Presently the ringed seal and to a much lesser extent the bearded seal (Erignathus barbatus), provide an important source of protein and part of the cash income of most arctic coastal villages. In addition the ringed seal is the main prey species of the polar bear (Ursus maritimus) (Stirling and Smith, 1975; Stirling and McEwan 1975; Stirling et al 1976) and one of the important food items of the arctic fox (Alopex lagopus) (Stirling and Smith 1975; Smith, 1976a). Both these species in turn provide an important part of the overall cash income of coastal Inuit hunting villages (Usher, 1971; Smith 1974; Jonkel, 1974; Brakel, 1976).

The Inuit from five western Canadian arctic villages, Tuktoyaktuk, Paulatuk, Sachs Harbour, Holman Island and Coppermine hunt the seals of the Beaufort Sea, Amundsen Gulf and Coronation Gulf. Few studies have been conducted in these areas. Stefansson (1944) gives useful information on the distribution and apparent movements of seals in the offshore ice of the western Beaufort Sea and areas north of Banks Island. Abrahamson (1963) discusses the distribution and utilization of ringed and bearded seals in the Tuktoyaktuk and Cape Parry areas. Abrahamson et al. (1963) studies the resource utilization including

marine mammals of the Coppermine, Holman, Bathurst Inlet, and Perry Island communities. Usher (1965 a, 1965 b, 1971) studied the economics of seal hunting at Coppermine, Holman and Sachs Harbour. Usher (1969) gives data on the size composition of seals taken during one season at Sachs Harbour. Stirling (1973) made recordings of the underwater vocalizations of ringed seals near Holman, western Victoria Island. Data on the techniques of a capture-recapture program and catch composition in 1971 at Herschel Island, Y.T. are given by Smith et al (1973). Smith (1974) gives a brief description of the interrelationships of the seals and their predators in the Beaufort Sea area. Burns and Harbo (1972) conducted an aerial census of ringed seals from Point Lay to Barter Island on the northern Alaska slope. Other studies of pinnipeds in Alaska have been mostly concentrated in the Bering and Chukchi Seas (e.g. Johnson et al 1966; Burns 1967; Burns 1970; Burns and Fay 1970). Stirling and Smith (1975) discuss the interrelationships of arctic ocean mammals and Smith and Geraci (1975) the role of arctic marine mammals in the ecosystem with the needs and direction of future research. Smith and Armstrong (1975) discuss levels of mercury in the marine mammals and principal prey species of the Inuit from Holman, N.W.T. Smith and Stirling (1975) deal with the description and function of the subnivean seal lairs and the breeding habitat in general. Smith (1976) describes the arctic fox in its role as predator of ringed seal pups in the Amundsen Gulf. Smith (1976 b) discusses the incidence and possible causes of disorientation in several species of arctic seals.

Dealing specifically with the Beaufort Sea Stirling et al (1976) discuss the abundance and distribution of ringed and bearded seals. Smith and Geraci (1976) conducted experiments on captive animals in order to assess their effect on contact with crude oil in the case of a well blowout or large scale spill. This research does not provide us with the capability to predict the effects of industrial development on ringed seals.

Brief description of the biology and ecology of the ringed seal.

The ringed seal is a medium size true (hair) seal, adults weighing approximately 130 lbs. on the average. It is circumpolar in its distribution along the arctic mainland and island coastlines. The species is solitary but seasonal aggregations may occur in the spring when it hauls out on the ice to molt, or in the fall when it feeds on concentrations of small fish.

The ringed seal is a generalist in its feeding, taking whatever plankton, bottom invertebrates or fish that are available. In the winter the arctic cod (Boreogadus saida) is the main food item and in the summer planktonic crustacea such as Themisto sp. and Mysis sp. also are important food components. The ringed seal appears to move inshore to feed in the summer months but a recent study (Geraci and Smith, 1975) shows that it is capable of very deep dives, and the far offshore areas of considerable depth are probably important winter feeding areas for the adolescent segment of the Beaufort Sea population.

A) During freeze-up, ringed seals use open leads and cracks in the ice to surface and breathe. Wind and ice pressure later create pressure ridges and ice hummocks in some areas. These areas also

have cracks associated with the pressured ice which the seals use as breathing holes. As the ice solidifies, the seals begin actively to keep their breathing holes open by abrading the ice with the claws of their foreflippers.

Before surfacing at these holes, the seal exhales in the water 2 to 3 meters under the breathing hole causing bubbles to burst at the surface of the water. The Inuit of Holman maintain that the behaviour allows the seal to test for the reaction of a possible predator before surfacing and thus determine if it is safe to breathe. Sometimes I have seen as many as four animals when I peered down a breathing hole.

The preferred breeding habitat is the stable fast ice of large bays and fiords (McLaren, 1958 a; Smith, 1973 a). The peak of the birthing season occurs in mid-April when one pup is born to each parturient female in a birth lair scratched out of snow (subnivean) above the breathing hole in the ice, Lairs are usually found in drifts in the lee and windward side of pressure ridges and ice hummocks. (Smith and Stirling, 1975). Nursing probably extends for a period of approximately two months. Breeding occurs shortly after the pup is born and there is a delay in growth of the embryo for approximately 80 days (Smith 1973 a). The period of delayed growth plus the active period makes the effective gestation period one year and serves to synchronize the annual reproductive effort.

B) Bearded Seals

The Bearded Seal Erignathus barbatus, shows a patchy distribution and is important to the Inuit mainly as a source of leather and protein. Along the mainland coast it is found in

relative abundance in such areas as Liverpool Bay, and south of Herschel Island. Along the west side of Banks Island, the area between Sachs Harbour and Norway Island contains a relatively high number of this species. The patchy distribution is probably directly related to their dependence on areas of good benthic invertebrate production, where they feed. The comparatively low number of Bearded Seals in the western Canadian arctic probably also reflects the low benthic invertebrate diversity and production in the Beaufort Sea (Macasey, 1974).

Studies in the Canadian western arctic.

The Beaufort Sea program.

My studies of ringed seals in the Amundsen Gulf - Eastern Beaufort Sea area began in 1971. We were fortunate because without this headstart we could not have carried out the program of testing the effect of oil on seals which was our specific role in the recent Beaufort Sea program. Even had we been able to develop the field techniques required to capture and maintain live experimental subjects in the short time constraints of the Beaufort Sea program, we would not have been able to interpret the results without the knowledge accumulated from several different sources over the four years preceding this program.

In 1972 a small field laboratory was erected near a netting site on the east side of Cape Parry, N.W.T., at the same time an indoor seal holding facility was established at the Ontario Veterinary College, University of Guelph. These facilities provide the opportunity to do short-term experiments on large numbers of freshly captured seals in the field and to continue these experiments on a subsample of animals at the indoor facility for as long a period as desired.

This yielded valuable information on several new topics including baseline physiological parameters. Detailed studies of the blood have proved to be useful monitors of population health status. Comparing values between netted seals and those which were rather startling. The netted seals showed evidence of stress which significantly altered blood cell concentration and distribution. This was important not only in that, for the first time, we were able to map the picture of stress in seals but also because it shed light on the confusing and inconsistent 'normal' blood values which have been reported for related species (Lane et al., 1972).

In 1972 the seal-capture operation was moved to Cape Parry. This was the same site used for the 1974 Beaufort Sea experiment. The results of this study which sought to determine the effects of immersion in, and ingestion of, Norman Wells crude oil, were rather surprising and really help to underscore the value of integrated field and laboratory impact studies. Possibly because of the atypical late ice conditions in the Beaufort Sea last summer the 96 ringed seals which were captured at Brown's Harbour were in a poorer nutritional state than animals collected at Herschel Island in 1971 and at the same Cape Parry netting site in 1972. This was strongly supported by hematologic data which could be compared to.

those from the 1971 Herschel Island blood study. The findings pointed to starvation and stress induced by adverse environmental conditions.

There was a marked difference in the reaction to oil immersion between seals immediately after capture in the field, and those transported to the Ontario Veterinary College. The three seals in the Guelph study died with 72 minutes of exposure to a surface layer of oil; six seals in the field survived a 24 hour exposure with only transient eye problems, and no evidence of permanent damage. The basic difference between the two study groups was the stress of transportation coupled with incomplete acclimatization to captivity of the Guelph seals. These findings have important implications. Imagine the reaction to an impact statement based on the Guelph experience. "Seals die within 72 minutes of exposure to oil....." On the other hand, if the captive experiment had not been done, we would not have known that a seal's response to oil can be greatly influenced by stress, the same kind of stress perhaps that we have noted in wild seals exposed to poor ice conditions, food inavailability, protracted moult, parasites, disease, etc. In fact a realistic interpretation of the effects of oil, could not have been achieved without the combined experience from the field and laboratory experiments.

All of the data accumulated during the Beaufort Sea study suggest that a major environmental disturbance, including a blowout, would not affect a seal population uniformly. Older seals and seals in poor nutritional condition are likely to be more sensitive than younger healthy seals. A blowout during a bad ice year, such as 1974, would be

more detrimental to seals which, as a whole, were in poor general condition, and presumably even more harmfully selective to the older animals within the population.

The studies conducted during the Beaufort Sea program are of an acute nature and will provide an accurate picture of the consequences of an oil blowout on ringed seals only when exposure to oil is of a short duration. This is likely to be the case only during the open water season from approximately July to October when the seals are free to move out of a contaminated area.

During the winter months ringed seals occupy lairs under the snow in both the nearshore and offshore stable ice in the Amundsen Gulf and Beaufort Sea. In March through May adult females give birth to a single pup in such a lair. While areas of exceptionally good breeding habitat have been identified in certain sounds and bays, these are relatively small and therefore the less densely occupied vast areas of offshore ice in the Amundsen Gulf and southern Beaufort Sea contribute significantly to the overall productivity of the region. The effect of exposure of breeding animals to an oil film under the ice cannot properly be assessed experimentally. Because the birth lair is connected to the sea by a breathing hole through the ice it would quickly become fouled by oil from the frequent coming and going of the adult female. The longer suckling period of the ringed seal and slower rate of growth would probably increase the possibility of thermoregulatory problems caused by an oil covered birth lair. It is not known whether the adult females would move out of the area thus abandoning the helpless pup or try to

take the pup with her. Either of these responses would tend to increase the probability of pup mortality. If the pup and female remained in the contaminated area there is a possibility that an oil fouled birth lair would melt earlier. This would expose the helpless pup both to the cold and to predation by arctic foxes or polar bears.

During this period the probability of ingesting large amounts of oil accidentally or from oil covered food species is not great. However, it is important to determine whether any of the prey species of the ringed seal might concentrate hydrocarbon metabolites which may be more toxic to the seal than the crude oil.

The non-breeding part of the ringed seal population (69 percent) tends to be distributed in the further offshore areas of less stable ice (McLaren, 1958). During the months of April - May in the southern Beaufort Sea large numbers of immature animals appear to be associated with the system of large leads running from Herschel Island toward the northwestern corner of Banks Island. This is the area where the proposed Canmar 1 and 2 drill rigs will be located. It is not known if this large segment of the ringed seal population is excluded from the more stable ice by the older breeding seals or if they are dependent on the open water because of greater food abundance or availability. The response of the considerable number of seals associated with areas of open water to an oil well blowout might be to move into the various productive areas under the ice thus crowding the breeding populations and resulting in

intraspecific stress with a resulting rise in mortality. Immature animals which could not feed successfully without the presence of uncontaminated open water might starve.

Beginning in early May ringed seals start hauling out onto the ice surface to bask in the sun. This hauling out behaviour is associated with the annual moult. During this period the large blubber reserves of the seals are reduced drastically. The exact cause of this weight loss is not known but is definitely not caused by a complete cessation in feeding since recent evidence has shown ringed seals to be night feeders at this time of the year. The large weight loss associated with the moulting period indicates that this is possibly the most stressful period in the life cycle of the sub-adult and mature ringed seals. Additional stress imposed by an oil blowout either by long immersion in oil, by interference with the regular hauling-out behaviour, or by necessitating large scale movements to avoid a contaminated area might have serious consequences.

Characteristics of the Beaufort Sea.

Generally the Beaufort Sea is seen to be less productive than other arctic marine habitats. Certainly comparisons between numbers of seals produced per unit of fast ice is much lower in the Beaufort Sea and Amundsen Gulf than along the east and south coast of Baffin Island (McLaren 1958 a; Smith 1973 a, b; Stirling et al, 1976). This is well supported by other studies involving primary and secondary producers (Grainger, 1976; Wacasey, 1976).

Recently we have accumulated evidence that the annual production of ringed seal pups can fluctuate greatly. This is contrary to the previous assumptions that ringed seal populations have a relatively stable recruitment. The exact causes or mechanism of these fluctuations are not known but they probably relate ultimately to fluctuations in annual marine productivity.

In such an area of low productivity with climatic features that might result in large scale variation in the annual standing crops of plankton and fish, the singlemost important adaptive feature of a seal population would be the ability to move to new and more favourable areas. We have direct evidence from capture-release programs that seals can move long distances. Strong direct and indirect evidence also supports the idea that there is a fall movement of seals westward along the eastern Beaufort Sea Coast. Presumably a reverse movement takes place in the summer during and after the breakup of the ice. Increased activity at these times of year might have serious effects, such as changing the seasonal distribution of seals resulting in increased natural mortality or shifts of whole populations out of an area.

The village of Holman on the west coast of Victoria Island, where I have been doing continuing studies for the last five years, takes the largest number of ringed seals in the western Canadian arctic. Preliminary calculations of seal production have been made based on population estimates of the seals in the Amundsen Gulf and reproduction rates derived from over 6,000 seal specimens obtained from the Inuit hunt. These indicate that in no way, could the peak annual harvests of upwards of 8,000 ringed

seals, be supported by the production of the Amundsen Gulf alone. Direct tagging evidence shows that seals from the southeastern Beaufort Sea are taken at Holman. I believe that the annual harvest at Holman is directly dependent on parts of the Beaufort Sea for its sustenance. The exact quantitative extent of this dependence is not yet calculated.

Ringed seals in the Beaufort Sea and Amundsen Gulf areas appear to depend on the whole inshore and offshore areas. I cannot make any simple recommendations about certain geographical areas to protect or ways of going about petroleum exploration to minimize the possible adverse effects on the population. In my mind the creating of a North Sea type of offshore oil field in the southeastern Beaufort Sea with its attending disturbance of seal populations will certainly affect the seasonal pattern of movement and dispersion. I feel strongly that the Beaufort Sea and Amundsen Gulf areas are one system and that the mobility of the marine mammal populations in these regions are important for their continuing wellbeing. The possibility of barriers to movement caused by a large scale development such as an offshore oil field cannot be discounted even though they cannot be tested experimentally "before the fact".

Recommendations for future research.

Recommendations of a specific type can be divided into two categories depending on whether offshore oil drilling is a "fait accompli" or not. If offshore drilling is to be delayed for some time points which should be further studied dealing specifically with the effects of contact with crude oil on ringed seals are:

1. Because of the dependence of ringed seals on the fast ice habitat for eight months of the year and the consequent longer period of exposure to oil should an under-ice blowout occur, more studies are needed on the chronic effects of contact with oil. In particular damage to eyes and kidneys should be thoroughly studied.
2. The main long-term effect of an oil well blowout will be contamination of food species and the reduction of food. The combined results of periods of starvation and additional stress imposed by the presence of oil in the water should be evaluated.
3. A study is needed on the reactions of young and old ringed seals to additional stress during the period of moult. Consideration should also be given to the further stress which should be induced by reduced food intake prior to and during the moulting season.

If the beginning of a gradual build-up of a large offshore oil field is imminent, serious thought should be given to (1) minimizing the adverse effects of such a development and (2) monitoring the effects. In the first category of prime importance would be to obtain more information on the pattern of movements in order to pinpoint migration routes if they do in fact exist. These data could be obtained over the long term by our continuing capture-release experiments but more quickly if an intensive sonic telemetry program was carried out.

The information could serve as the basis of specified recommendations such as avoiding certain critical localities or the cessation of activity during critical time periods.

In the category of monitoring the effects of what generally could be called disturbance the following research programs would be useful:

1. Annual studies of stress indicators in freshly captured or shot seals. It is essential to begin a program of research to quantify the several indicators of stress which we have recently identified (Geraci and Smith, 1975).
2. The recently documented large scale annual variation in the production of ringed seals and the lack of data on the lower producers points out our inadequate knowledge of the lower trophic levels. A program should be designed to monitor primary and secondary productivity periodically throughout the year over a large part of the Beaufort Sea.
3. The collection of accurate statistics on catch per unit effort in the important seal hunting communities in order to determine if the exploited seal stocks have been diminished.
4. The collection of an adequate age sample of seals from the hunting communities to document shifts in production or in certain age segments of the population.
5. The annual surveying of hauled-out seals during the initial development of the oilfield to obtain population estimates especially in the critical shear zone or transition area.

6. A continuation of the breeding habitat survey started in 1974 (Smith and Stirling, 1975) which is the best single indicator of ringed seal productivity.

Conclusions

The difficulties in studying most components of the arctic ecosystem can be overcome only with long-term studies. After eight years of investigating ringed seals, only recently have findings such as large scale variations in production, abundance, nutritional and health status been uncovered. More time will uncover more relevant factors and perhaps give us some insight into their wide-felt influence. The pace of the arctic is too slow to be subjected to headlong invasions by scientists working against unrealistic time constraints. Such was the Beaufort Sea Project. These invasions we call impact studies and rightly so, as the studies themselves are sure to have some impact on the system.

The more sensible approach is to start now on a series of integrated studies, some directed to specific trophic levels, including the consuming native peoples, others on areas that may be treated as closed systems, so that we may gain more knowledge of the controlling factors inducing natural variations. Only then can we begin to understand the effects of man-induced influences.

Such studies are more practical and therefore more economical; they are more productive and, in simple fact, they make more sense.

Western Region
Fisheries and Marine Service

Resume of Experience

Academic Achievements: High School - Manitoba & Alberta

Military Experience : 3 years RCN 1959-1962
ABAF 46508-H

Career Progress:

- 1967-1969, Dept. of Fisheries - casual positions in enforcement and technical capacities.
- 1969-1970, GT 1 Enforcement Officer - Dept. of Fisheries.
- 1970-1972, GT 2 Enforcement Officer - Fisheries and Marine Service.
- 1972, GT 3 Head of Environmental Control Section - Fisheries and Marine Service.
- 1972-1975, GT 4 Officer-in-Charge Western Subdistrict - Fisheries and Marine Service.
- 1975-1976, Chief of Enforcement - Fisheries and Marine Service, Western Region.
- 1976- , Acting District Manager, Fisheries and Marine Service.

Advanced Training:

- Management Course for supervisors
- Effective Report Writing and Oral Communications
- Law Enforcement Course - Vancouver Police Academy
- St. John Ambulance - Advanced First Aid
 - First Aid Instructor
 - Training Officer - N.W.T.
- Canada Emergency Measures Organization
- Arctic Survival Training
- In-service Job Description Writing Course

Associations:

Executive Council - Northwest Wildlife Law Enforcement Association.

Publications:

Fishery Officers Manual (1975).

Offshore Seismic Seminar
Yellowknife, N.W.T. - May 12-13, 1975

Summary:

I have been involved for the past eight years in Fishery Management at all levels with particular emphasis on regulations and law enforcement. I have been associated with other agencies responsible for wildlife management, non-renewable resource management (4 years as representative on Land Use Advisory Committee) and I have several years of experience in training both as instructor and program manager both with Fisheries and Marine Service and St. John Ambulance. Much of my work has been with Native Canadians both Indian and Inuit peoples in The Northwest Territories where I have resided for the last ten years.

H. R. Trudeau

